[10537/284]

VEHICLE SEAT WITH SUPPORT FOR THE LOWER LEGS

The invention relates to a vehicle seat according to the features of the precharacterizing clause of claim 1.

German utility model G 92 00 777.5 shows a bus seat with a footrest. The footrest is coupled to the seat cushion of the bus seat via a of parallelogram linkage mechanism. A gas-filled spring interacts with the parallelogram linkage mechanism in order to swing the footrest from a stowaway position arranged below the seat cushion into a position of use. The position of the footrest cannot be set in a variable manner here, and so this seat does not provide a very comfortable sitting position for very tall or very short people.

DE 27 47 592 A1 discloses a vehicle seat which is mounted displacably in a rail in a vehicle. The vehicle seat can be moved in the rail via an electric motor. In order to prevent the driving motor from being damaged if the seat should be blocked, said driving motor has a sliding clutch which disengages the driving motor in the event of overload.

It is the object of the invention to provide a vehicle seat which is of compact design and has a comfortable sitting position and a comfortable relaxing position, is simple to operate and has great reliability against incorrect operation.

This object is achieved according to the invention by a vehicle seat according to the features of claim 1.

The vehicle seat has a lower leg support which can be moved from a stowaway position into a position of use and can be fixed in a freely selectable position. The lower leg support has an overload safeguard which releases the fixation of the lower leg support in the event of overload, thereby allowing the lower leg support to give way. Damage to the lower leg support as a consequence of incorrect operation is therefore largely prevented.

A comfortable vehicle seat should provide good leg support in the relaxing position. The legs should preferably be supported over their entire length. The vehicle seat therefore has a lower leg support having an advantageously continuous supporting surface. The lower leg support is fastened pivotably to the seat cushion or to a seat frame of the seat cushion. The inclination and/or length of the lower leg support can be adjusted in an automatically driven manner. It is therefore possible for people of different heights to set a comfortable sitting position matching their height.

In the relaxing position, the lower leg support can reach a long way into the footwell and can have a long lever arm. If, during the automatic adjustment, the footrest is moved against an obstacle or a great force is exerted on the footrest, e.g. by a person standing on the footrest or by heavy objects being deposited thereon, a correspondingly large force therefore acts on the securing means of the footrest. If the force is large enough, the vehicle seat could be damaged. The overload safeguard limits the force to a preferably presettable value.

The overload safeguard can trigger if the lower leg support is subjected to loads on both sides. It is thus possible for a downwardly directed overload to be caused, e.g. by

means of heavy objects deposited on the lower leg support. Following a response of the overload safeguard, the lower leg support can drop away downward as far as the vehicle floor. Similarly, an upwardly directed force can act on the lower leg support, e.g. when the lower leg support is automatically lowered as a consequence of an obstacle, for example a piece of luggage situated under the lower leg support. The triggering of the overload safeguard limits this force to a maximum value which is dimensioned in such a manner that the remaining force does not cause any damage to the lower leg support and/or to the vehicle seat.

It is possible to use the vehicle seat according to the invention in passenger vehicles, buses and in watercraft or rail vehicles. Even a use of the vehicle seat according to the invention as a comfortable passenger seat in airplanes is envisaged.

Further features and embodiments of the invention emerge from the claims, the figures and the description of the figures. The features and combinations of features which are mentioned above and are explained below can be used not only in the respectively indicated combination, but also in other combinations or on their own without departing from the scope of the invention.

Further details of the invention are illustrated and explained in the figures, in which:

figure 1: shows an illustration of the vehicle seat with the lower leg support in a position of use,

figure 2: shows an illustration of the lower leg support with an automatic inclination adjuster in the stowaway position and in a position of use,

figure 3: shows an illustration of the inclination adjuster with an overload safeguard,

figure 4: shows a schematic illustration of an overload situation,

figure 5: shows a disk of the overload safeguard.

Figure 1 shows a vehicle seat 1. It has a backrest 11 with head restraint 12 and a seat cushion 2 with a lower leg support 3. The vehicle seat 1 is mounted in a vehicle, e.g. in the rear of a passenger vehicle, in a manner such that it can be displaced via rails 14. A belt retainer 13 for a three-point belt is integrated in the backrest 11. The backrest 11 and the seat cushion 2 each have padding together with an upholstery fabric, preferably leather. The seat cushion padding 21 upholsters the seat cushion 2 and the lower leg support 3 and is of continuous design. On its upper side, it forms a cohesive, padded seat surface which extends from the seat cushion 2 as far as the lower leg support 3.

In the relaxing position or position of use which is illustrated figure 1, the lower leg support 3 is deployed forward. It has been pivoted and extended forward and upward in order to enlarge its supporting surface for the lower legs. One end of the lower leg support is mounted pivotably on the seat cushion 2 or on a seat frame of the seat cushion 2 while the other end reaches a good distance into the footwell. The seat cushion 2 together with the lower leg support 3 forms an approximately horizontally arranged, continuous supporting surface for the legs of the seated person.

The lower leg support 3 has a three part telescope with an upper telescopic element 32, a central telescopic element 33 and a lower telescopic element 34. In order to vary the length of the lower leg support 3, the telescopic elements 32, 33, 34 can be telescoped via an electric drive. A footrest 4 is arranged at the lower end of the lower leg support 3. Said footrest is connected to the lower telescopic element 34 and has a foot plate 41, which is mounted on a crosspiece, is swung out into the position of use and provides a comfortable support for the feet. The foot plate 41 can be pivoted about an axis of rotation running transversely with respect to the lower leg support 3, and is approximately perpendicular with respect to the lower leg support 3 in the position of use. One end of the lower leg support 3 is connected to the seat cushion 2. The inclination of the lower leg support 3 relative to the seat cushion 2 can be set via an inclination adjuster 5 having an electric driving motor 51. The other end of the lower leg support can be moved freely and supports the footrest 4.

In addition to the relaxing or reclining position illustrated in figure 1, the vehicle seat 1 has further sitting positions, preferably also an upright sitting position with the lower leg support 3 retracted and the footrest 4 swung in.

Figure 2 shows the lower leg support 3 firstly in a stowaway position with retracted telescope 32, 33, 34 and secondly in a position of use with extended telescope 32, 33, 34. The lower leg support 3 is connected pivotably to the seat cushion 2 via an electrically driven inclination-adjusting device 5. The inclination-adjusting device 5 is arranged at the upper end of an upper telescopic element 32. It has a driving motor 51 which pivots the lower leg support about

the axis of rotation 52, which runs through the inclination adjuster 5, via a self-locking gear mechanism.

The lower leg support 3 has a three-part telescope with an upper telescopic element 32, a central telescopic element 33 and a lower telescopic element 34. The foot plate 41 is fastened pivotably to the lower telescopic element 34. The telescopic elements 32, 33, 34 are designed and dimensioned in such a manner that they can largely be driven one inside another, with the uppermost telescopic element 32 accommodating the others. The lower leg support 3 therefore requires only a small storage space in the stowaway position and at the same time has a large usable length in the position of use. The upper telescopic element 32 has laterally arranged guides which secure the slide 31. The upper side of the slide 31 that faces the seat padding 21 has fittings for attaching the seat padding 21.

The inclination-adjusting device 5 is shown in figure 3 in a perspective view. It has a shaft 53 having an overload safeguard 6. The overload safeguard has two disks 61, 62 which are arranged parallel to each other on the shaft 53 and such that they rest directly on each other. They are accommodated in a housing and are acted upon by a disk spring. The disk spring presses the disks against each other. The first disk 61 is connected in a rotationally fixed manner to the driving motor 51, and the second disk 62 is connected in a rotationally fixed manner to the shaft 53 of the inclination adjuster. Via an intermeshing toothing 63, which is formed on the opposite sides of the disks 61, 62 and is shown in figure 5, the disks 61, 62 have a frictional connection, with the result that the torque produced by the driving motor 51 is transmitted via the disks 61, 62 to the shaft 53 in order to pivot the lower leg support 3.

The toothing 63 arranged in an encircling manner around both disks and designed in such a manner that the toothing 63 of the first disk has a complementary shape to the toothing 63 of the second disk 62. The two toothings 63 of the disks 61, 62 mesh together in a form-fitting manner acted upon by the disk spring. The teeth 64 of the toothing 63 are designed such that they taper conically, with the result that their flanks or side surfaces 65 are beveled on both sides of a tooth 64.

If a torque is transmitted via the disks 61, 62, the oblique side surfaces 65 are mutually supported and push the disks 61, 62 apart counter to the spring force of the disk spring. If the torque which is to be transmitted exceeds a certain threshold, then the toothings become disengaged, so that the disks 61, 62 no longer have a frictional connection. The lower leg support 3 can now be freely pivoted. The maximum torque which can be transmitted via the overload safeguard 6 is therefore limited. The amount of torque which can be transmitted at maximum can be set by coordinating the spring force of the disk spring and the angle of the side surfaces 65.

The overload safeguard is designed in such a manner that the disks 61, 62 can come into engagement only in a defined position with respect to each other. The isogonality of the lower leg support 3 is therefore ensured, e.g. for an electronic control. For this purpose, the toothing 63 has asymmetrical shaped fitting marks 66. It is therefore ensured that, when the overload safeguard is triggered in a certain position of the lower leg support 3, the latter can move away in the direction of the force. After the application of force is removed, the lower leg support 3 has to be brought manually back into the starting position.

Only in this starting position is it possible for the overload safeguard to snap into place.

Figure 4 schematically illustrates an overload situation as may frequently occur in practice as a consequence of incorrect operation. The lower leg support 3 is arranged in a position of use and supports the lower leg of a seated person. The seat cushion 2, which is connected to the lower leg support via the overload safeguard 6, supports the thighs of the seated person. The seated person presses his foot against the swung-out foot plate 41. The force introduced as a result into the lower leg support is illustrated by arrows. The dispersion of the force causes the lower leg support to be pressed downward toward the vehicle floor. If, as a consequence of a kick or a crash, the pressing force is too great, the lower leg support could be damaged and/or the seated person could incur injuries. In order to limit the maximum force, the overload safeguard triggers after a certain value of this force. The lower leg support can now be pivoted away downward and is not damaged, and/or the maximum force acting on the foot is limited.